

Solar Thermal

Leon Bontrager (574) 536-9483 leonb@HomeEnergyLLC.com www.HomeEnergyLLC.com Home Energy LLC has been helping people worldwide make use of the sun and wind's inexhaustible sources of energy since 2000. We have designed and installed hundreds of Solar renewable energy systems, including the Museum of Science and Industry exhibit *Smart Home*, colleges and universities, residential, and commercial.



Museum of Science & Industry



Ball State University



Residential

HOME ENERGY background

- Full service renewable energy contractor
 - Education, sales, installation, and service



- Grid-tie and off-grid solar and wind systems
- Solar thermal systems
- Battery back-up systems utilizing power inverters

HOME ENERGY background

- North American Board of Certified Energy Practitioners (NABCEP) – Leon Bontrager
 - One of seven statewide!
 - National certification organization for professional installers in the field of renewable energy



HOME ENERGY our vision



Our vision is to educate the American public about the technology and use of Renewable Energy.

We want to empower you with helpful facts so you can make informed decisions.

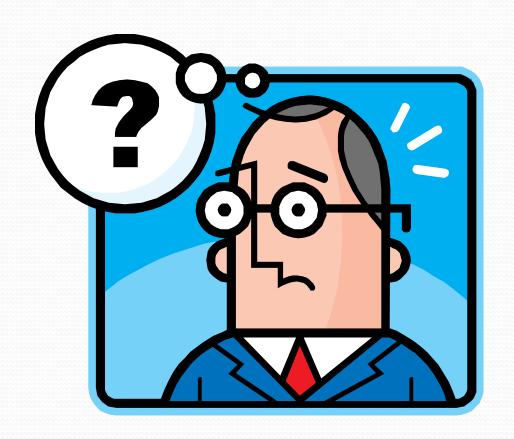
"One Person can change the world One Pound of Coal at a time. Together, we can change it by the Mega-Ton!"

Solar Thermal an overview



- Its An Uncertain World....
 - Rising Oil Prices
 - Political Instability
 - Environmental Concerns
 - Sluggish Economy

• What's The Good News?



Home Energy is solar energy a new concept?

No! Solar energy has existed since the beginning of time. Solar energy simply means energy (light or heat) that comes from the sun.



 More sunlight falls on Earth in one hour than is used by its entire population in one year

IT IS NOT SOLAR THERMAL ENERGY solar electricity is photovoltaic (pv) energy

Photovoltaic (PV) technology means the ability to convert light directly into electricity and using it to power appliances, computers, lights, etc.



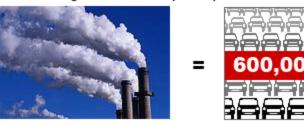
Solar thermal is about capturing heat from the sun and using it to heat a home and water, which reduces the amount of gas or electricity your water heater consumes.

RENEWABLE ENERGY sustainable solutions

Environmental Benefits

(reducing carbon & mercury emissions, not generating as much radioactive waste)

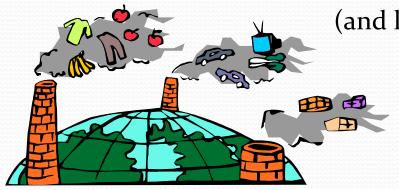




produces the annual global warming emissions equivalent of roughly 600,000 cars

Greater Self Reliance / Resilience

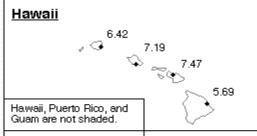
(and less dependence on foreign energy)

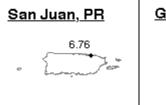


Pride in Ownership

(satisfaction in taking part in solutions!)

Alaska



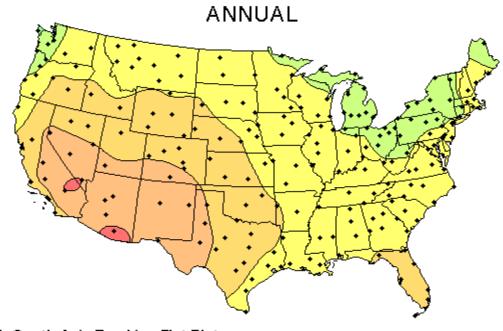




Collector Orientation

One-axis tracking flat-plate collector with axis oriented north-south at no tilt angle: These trackers pivot on their single axis to track the sun, facing east in the morning and west in the afternoon.

Average Daily Solar Radiation Per Month



North-South Axis Tracking Flat Plate

This map shows the general trends in the amount of solar radiation received in the United States and its territories. It is a spatial interpolation of solar radiation values derived from the 1961-1990 National Solar Radiation Data Base (NSRDB). The dots on the map represent the 239 sites of the NSRDB.

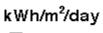
Maps of average values are produced by averaging all 30 years of data for each site. Maps of maximum and minimum values are composites of specific months and years for which each site achieved its maximum or minimum amounts of solar radiation.

Though useful for identifying general trends, this map should be used with caution for site-specific resource evaluations because variations in solar radiation not reflected in the maps can exist, introducing uncertainty into resource estimates.

Maps are not drawn to scale.



National Renewable Energy Laboratory Resource Assessment Program



















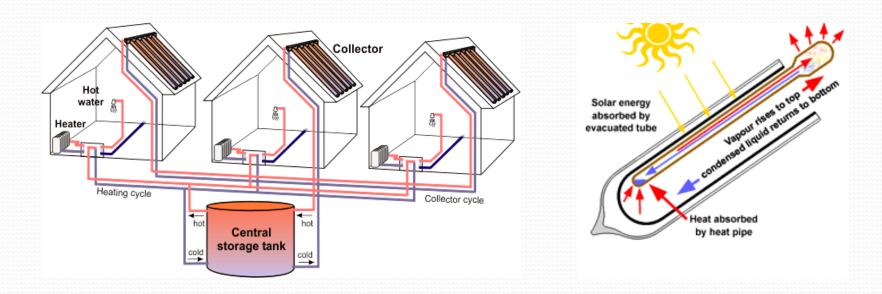
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SOLAR THERMAL an overview



solar thermal it is not solar electricity

Solar Thermal Technology is about capturing the sun's heat.



Solar Electricity (Photovoltaic) is about making electricity directly from the sun.

solar Thermal about

- Pool heating
- Space heating
- Heating domestic hot water
- Air conditioning
- Making steam to run electric turbines



solar thermal about

- Solar thermal energy uses sunlight to heat water, air or building
- Reduces costs by reducing electricity and Gas needed for these tasks
- Solar water heating

Heat water used for laundry, bathing, dishes, etc.; or

commercial and industrial uses

Solar air heating

 Supplemental heating source – reduces load on primary system by warming air in building during daylight hours



solar thermal about



- Flat Plate collector advantages include:
 - Established and familiar, so more accepted
 - High quality with very low failure and repair rates
 - Low risk of overheating if system is left idle in summer heat



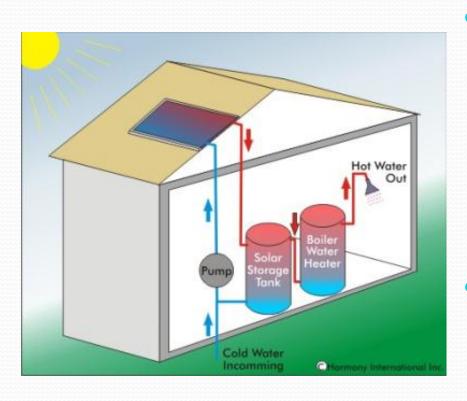
- Evacuated Tube collector advantages include:
 - Collects more heat on cloudier & low sun days
 - Collect more heat on the coldest days
 - Components weigh much less and are faster to erect
 - Can be installed vertically or horizontally on an exterior wall
 - Can be more easily expanded

solar THERMAL water heating

- Can provide up to 80% of annual energy needed to heat water for a home or business
- Typical residential system reduces need for conventional water heating by about 2/3
 - Minimizes expense of electricity to heat water and reduces associated environmental impacts



solar THERMAL water heating



- Back-up energy source
 (electric or gas) is activated
 if water in tank falls below a
 minimum temperature on
 cloudy days or times of
 increased demand
- Retrofit valves can often be used to allow solar to connect to existing cold water inlet

solar THERMAL space heating

- Collectors collect and absorb solar radiation
- Electric fans or pumps transfer and distribute solar heat
 - Also need energystorage system to provide heat when sun is not shining
 - Usually configured to also provide water heating



solar thermal rules of thumb

- Each 25-tube (SunQuest 250) collector will generate roughly 20,000 BTUs of clean heat energy per <u>Hour</u>
- Most 30-tube collectors will generate roughly 41,000
 BTUs of clean heat energy per <u>day</u>
- Most oil boilers burn at roughly 75% efficiency to produce domestic hot water or space heat
- Most Gas Furnaces are 80% 92% efficient



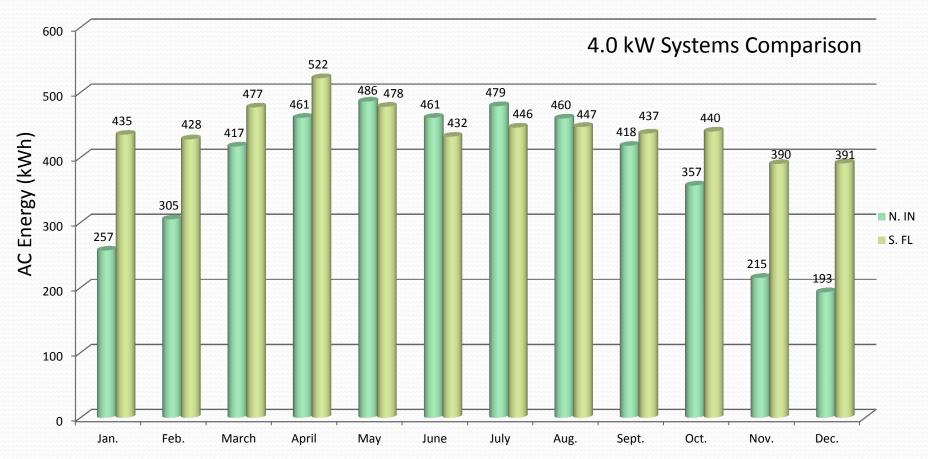
FREQUENTLY ASKED QUESTIONS solar energy



is it *really* sunny enough here for solar? YES!

- Solar systems generate power in all types of weather partly cloudy days, can turn out as much as 80% of their potential energy
 - On extremely overcast days, can still produce about 25% of their maximum output
- Germany has fewer sun hours than Indiana average of 1 hour less/day
 - BUT they are second in the world for Solar Energy use!
 - Germany gets 14.2 percent of its electricity from renewable sources!

is it really sunny enough here for solar?



A solar electric system will work about 85% as well in Northern Indiana as one in Southern Florida. *An Indiana system can out-produce a Florida system 1/3 of the year!*

PHOTOVOLTAIC'S Will Solar be heavy & put holes in my roof?

- Collectors are less than 5 pounds per square foot
 - Typically framed roof is more than adequate to carry weight
- We mount panels on purpose-built aluminum rail system - fastened about every 6' by penetrations into roof rafters
 - Standing seam metal roof attachments are made directly to the standing seams - no roof penetrations
 - Asphalt roofs each mount is sealed with 50-year silicone sealant to prevent leaks

PHOTOVOLTAIC'S how much does it cost?

- On average \$.20 per K/BTU (\$375.00 per year savings in gas per collector) After 30% tax credit this system will pay for itself in 4-7 years!
 - Not including maintenance
 - Little maintenance is required, though visual checks of panels and regular systems checks are recommended
- Financing can be attractive alternative for many homeowners

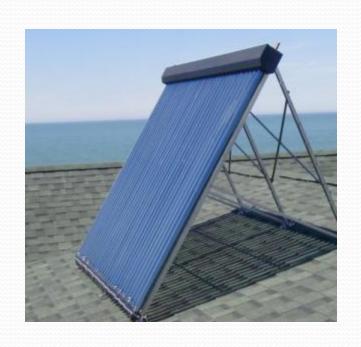
PHOTOVOLTAIC'S what is the system's payback?

Payback measures the *years* before capital is recovered through savings.

- Typically look at 30 years of operation to calculate expected returns 20% ROI
 - Expect gas costs to increase 6-9
 percent per year over the next 20
 years making the value of Solar
 thermal increase
- Also depends on incentives you can receive
 - Federal tax credit is now a full 30%
 - Federal , State and Utility grants or rebates



solar THERMAL what is the system's payback?



- Annual gas savings will differ depending on location and hot water use
- For "normal" household that spends 25% of electricity bill on hot water heating, cost may be recovered in as few as 5-6 years in reduced bills
- Your current water heater won't even do that!
- Water heating bills should drop 50% 80%

STATE & FEDERAL incentives







- Web Address: <u>www.dsireusa.org</u>
- of information on state, local, utility and federal incentives and policies that promote renewable energy and energy efficiency.
- Established in 1995 and funded by the U.S. Department of Energy, DSIRE is an ongoing project of the N.C. Solar Center and the Interstate Renewable Energy Council.

incentives federal

Business & Residential

• 30% investment tax credit (ITC) - no limit, can be taken on all material, labor and even on the sales tax and grant portion of the project!

http://www.dsireusa.org/incentives

incentives federal

- REAP Grant Program
 - Grants for businesses, industry, and farms in Rural Area of less than 50,000 population. 25% of complete job cost up to \$20,000.00 per project!
 Total budget of 1.4 Million – last year 100% of applications funded!

Comprehensive Data Base of Federal and State Tax Incentives and Grants for Renewable Energy and Energy Efficiency Projects

•Sample Incentives Include:

- Energy Efficient Commercial Buildings Tax Credit
- Business Energy Investment Tax Credit
- MACRS/ Bonus Depreciation
- Residential Renewable Energy Tax Credit
- Dept of Treasury- Renewable Energy Grants

frequently asked questions



how do I choose a renewable energy contractor?

A good renewable energy contractor:

- Will give an estimate (or range) of system size appropriate for site and give a detailed,
 formal proposal/bid/estimate in writing
- Will give energy savings and environmental benefits expected based on the information you provide
- Should be very clear what is and is not included

AVOID:

- Contractors who do not return your call promptly good indication that they will not show up or finish on time
- If it sounds "too good to be true" it is!

The truth is that <u>not every application will work at every site</u>, and our promise to you is that we will not try to sell you something if it is not right for you, and we won't use products that are not proven to work.

FREQUENTLY ASKED QUESTIONS how do I choose among competing bids?

- You can evaluate bids in a number of ways
 - Costs
 - Service warranties
 - Customer service
 - Handling of rebates
 - Availability
 - Years of experience
 - Other qualifications & certifications
- Price should not be only consideration bids should vary less than 5% when based on same parameters - including equipment, parts, shipping, labor, etc.
- Ask potential contractors for references

what kinds of permits & inspections are required for a RE system?

- Requirements vary but check with county planning or permitting department to find out about zoning regulations and permit requirements
 - Zoning controls whether you can install
 - Permitting controls how you install

Your contractor should be able to assist you in obtaining permits from your local officials.

FREQUENTLY ASKED QUESTIONS why shouldn't I just buy it all online?



- Online deals often product from person who knows nothing about solar panels or wind generators
- Compare shipping costs make sure actually have availability and products are not seconds
- Be aware not usually selling any of the miscellaneous components - add up faster than you may expect!
- To qualify for some government-funded incentives you may be required to work with a certified installer

FREQUENTLY ASKED QUESTIONS how does RE fit into LEED?

LEED Points

Solar Water Heaters backup:

≥ 40% of Annual DHW load 2 Points

≥60% of Annual DHW load 3 Points

RESOURCES want to learn more?

- Database of State Incentives for Renewables & Efficiency <u>www.dsireusa.org</u>
- US Dept. of Energy Energy Efficiency & Renewable Energy <u>www.eere.energy.gov</u>
- Indiana Renewable Energy Association <u>www.indianarenew.org</u>
- Interstate Renewable Energy Council <u>www.irecusa.org</u>
- North American Board of Energy Practitioners <u>www.nabcep.org</u>
- Network for New Energy Choices <u>www.newenergychoices.org</u>
- National Renewable Energy Laboratory <u>www.nrel.gov</u>
- Wind Works by Paul Gipe <u>www.wind-works.org</u>
- Home Energy LLC <u>www.HomeEnergyLLC.com</u>
 - <u>leonb@homeenergyllc.com</u>



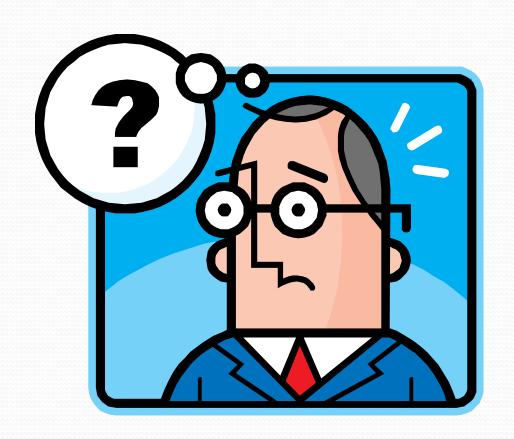
Your Solar America Team

Timing is Everything!



- Its An Uncertain World....
 - Rising Oil Prices
 - Political Instability
 - Environmental Concerns
 - Sluggish Economy

• What's The Good News?



Introducing the REVOLUTIONARY NEW SunQuest-25 Solar Panel!

- Designed and Patented by Solar America Solutions, an Indiana Company
- •Proven in lab testing to be up to 40% more effective than any other solar thermal collector
 - Unprecedented output- Up to 25,000Btuh
- Offering a full line of products, including Pump Stations, Controllers and much more



Solar Thermal Energy Projects



Project #1

- 12,000 Sq Ft Commercial Building in Central Ohio, used for truck and heavy equipment repair and service.
 - 20 foot ceiling height made conventional heating extremely expensive.
- Cold concrete floor is extremely uncomfortable and adversely effects workers performance.

Solution

 Radiant floor heat with solar thermal as primary heat source.





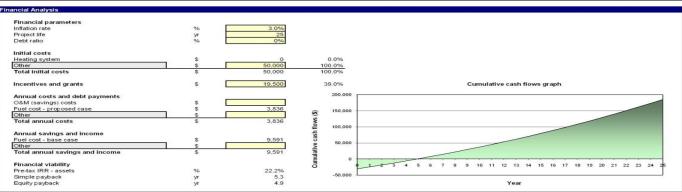




RETScreen Energy Model - Heating project

					Incremental
		Base case	Proposed case		initial costs
Heated floor area for building	ft ²	12,500			
Energy efficiency measures			60%		
Heating load for building	(Btu/h)/ft ²	25	10		
Domestic hot water heating base demand	%	0%	0%		
Total heating	MWh	168	67		
Base load heating system					
Technology	170		Other		
Capacity	kVV	91.6	92.0	251.1%	
Heating delivered	MWh	167,9	67.2	100.0%	
Fuel type		Propane - gal	Propane - gal		
Seasonal efficiency	%	94%	94%		
Fuel consumption - annual	gal	6,394	2,558	gal	
Fuel rate	\$/gal	1.500	1.500	\$/gal	
Fuel cost	\$	9,591	3,836		
Peak load heating system					
Technology					
Suggested capacity	kW		0.0		-
Capacity	kW			0.0%	
Fuel type			Natural gas - m ³		
Seasonal efficiency	%				
Fuel consumption - annual	m ^a		0		
Heating delivered	MWh		0.0	0.0%	
Fuel rate	\$/m ³				
Fuel cost	\$		0		

GHG emission					
Base case	tCO2	37.2	_		
Proposed case	tCO2	14.9			
Gross annual GHG emission reduction	tCO2	22.3			
GHG credits transaction fee	%				
Net annual GHG emission reduction	tCO2	22.3	is equivalent to	4.1	Cars & light trucks not used
GHG reduction income					
GHG reduction credit rate	\$/tCO2				



Project #4- FCC Indiana Industrial Process Water Heating

- 700 Gallon per Day Water Usage
- Inbound water temperature- 65°
- Required water temperature- 125°
- Approximately 18 hours lost production time weekly

Indiana Department of Energy APE Grant Recipient



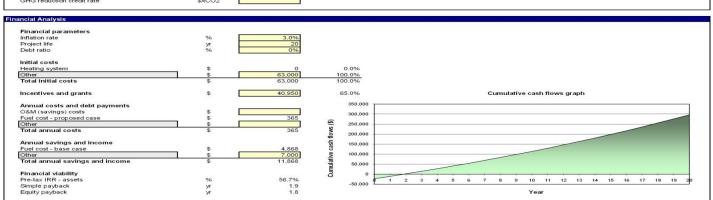
Solution

•Solar thermal energy for primary source of water heating, 93% efficient boiler for secondary heat source.





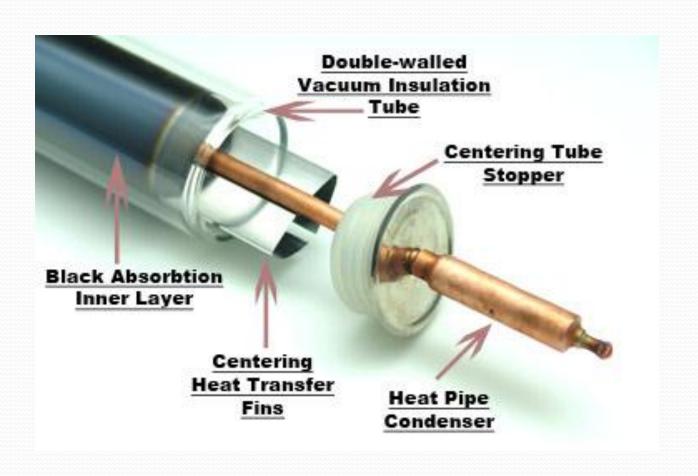


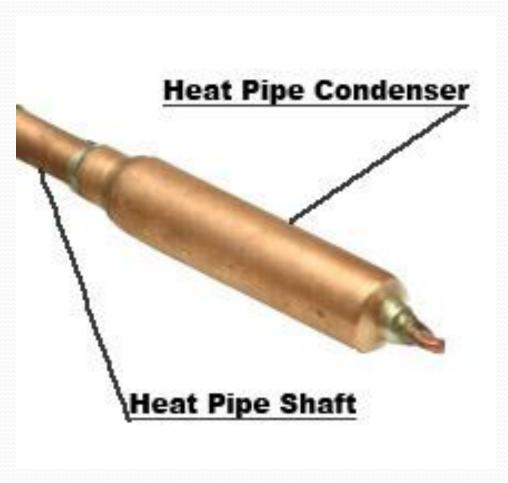


Solar Thermal System Components



Evacuated Tube







Air Vent and Shut-Off Valve

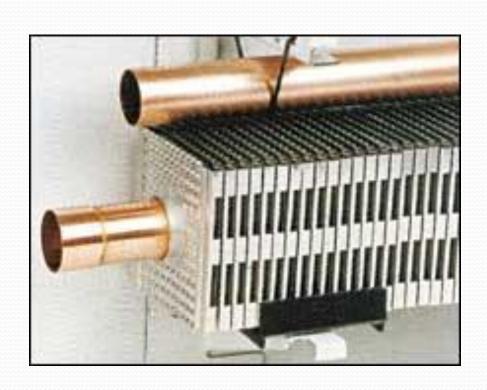




Components of a Solar Thermal System Automatic Diverting Valve



Components of a Solar Thermal System Heat Dissapator

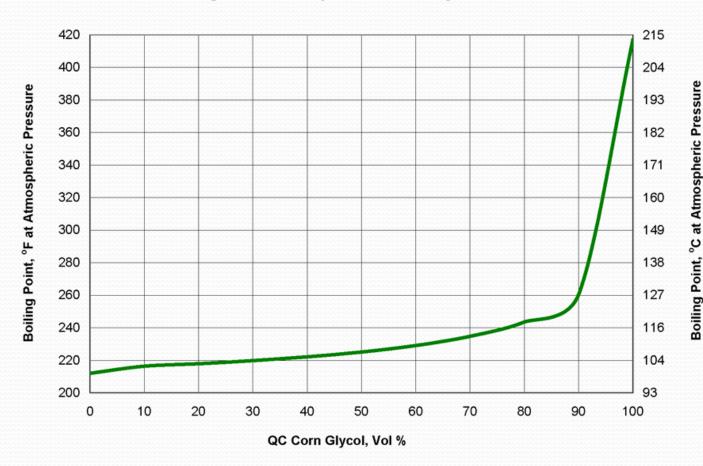


Pump Station and Controller





Boiling Points of Aqueous Corn Glycol



Thermastatic Mixing Valve



Solar Phoenix



SuperStor Solar w/Dual Heat Exchangers



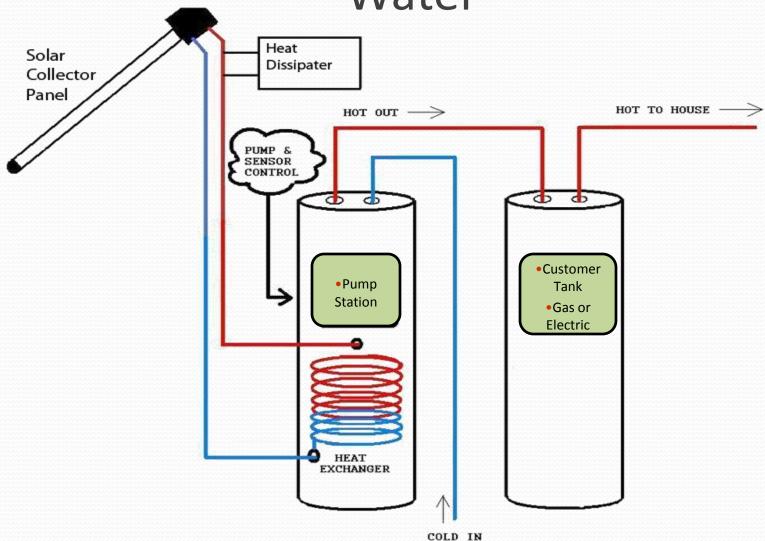
Sizing An Array of Solar Collectors

•When you have completed computing the heat load of the building, the result will be expressed in Btuh. Divide the expected load by 25,000, the Btuh output of the SunQuest Solar Thermal Collector. This result will give you the <u>minimum</u> number of panels to be used on the project.

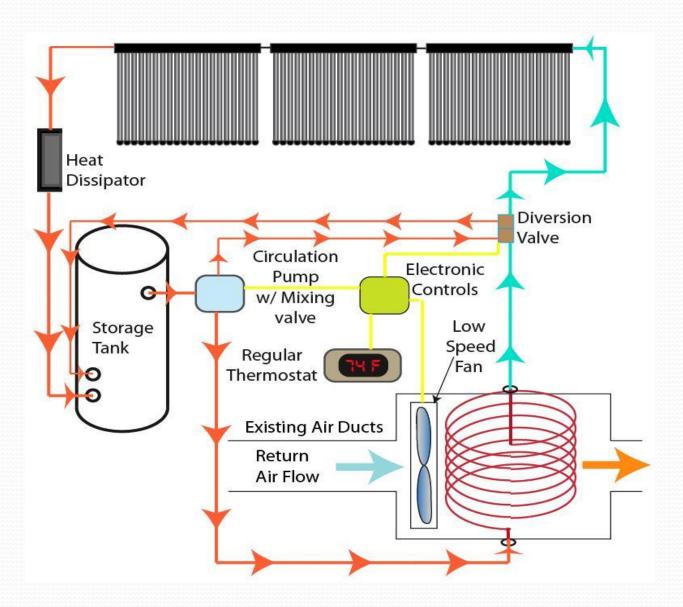
Sample System Drawings



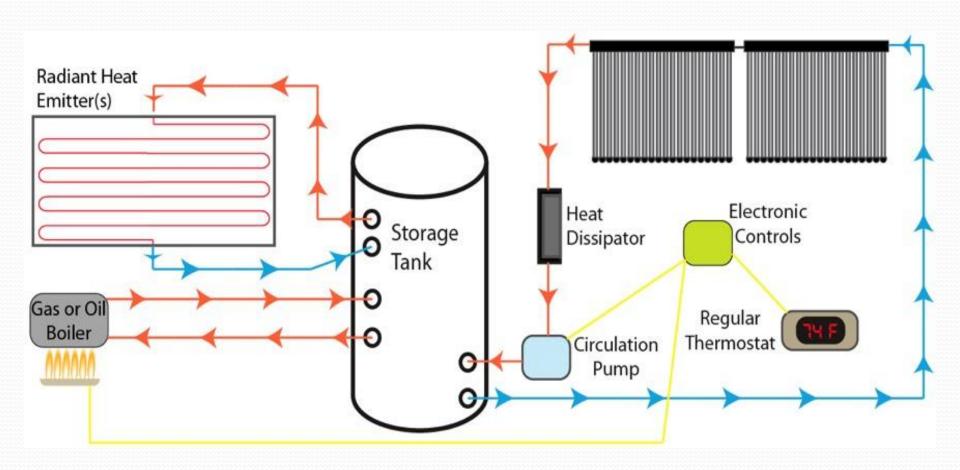
Pre-Heating Domestic HotWater



Forced Air Space Heating



Baseboard Space Heating



Radiant Floor Heating

